



The MathWorks in the Automotive Industry

Every major automotive OEM and supplier in the world uses MathWorks™ products throughout their design, development, analysis, calibration, and test processes.

MATLAB® and Simulink® enable engineers to explore and analyze ideas, model and simulate systems, rapidly prototype concepts in the vehicle, and automatically generate code for deployment to production hardware. These products also improve communication between suppliers and OEMs by providing a common platform for sharing system specifications and development ideas.

Engineers use MathWorks tools to design and test intelligent vehicle systems, including powertrain systems, chassis and safety controls, comfort and convenience systems, and driver infotainment systems.

System-Level Modeling

Using MATLAB and Simulink technical computing software, automotive manufacturers and suppliers are developing mathematical models to describe the behavior of the vehicle system, simulate expected performance, and validate requirements. Activities include:

- Vehicle-level and system-level modeling
- Physical systems modeling
- Algorithm modeling

Electronics and Software Design and Implementation

Engineers use Simulink and other MathWorks products to run real-time plant simulations

with hardware-in-the-loop systems, rapidly prototype ideas on real vehicle systems, and generate production C code from models. Tasks include:

- Algorithm design
- Rapid prototyping
- Production C code generation
- HDL generation and DSP testing
- Hardware-in-the-loop testing
- Verification and validation

Powertrain Calibration and Testing

Powertrain engineers and calibrators use MathWorks products to design, integrate, and test their systems. They also validate system performance against the requirements by performing:

- Powertrain calibration, testing, and validation
- Dynamometer and test cell development
- Test and measurement

Vehicle Analysis and Validation

Engineers use the MATLAB family of products to analyze large amounts of vehicle testing data. Activities include:

- Data acquisition and visualization
- NVH analysis
- Engine mapping
- Driving test analysis

Customer Successes

General Motors created the AHS II hybrid powertrain by using models to continuously verify their design, test prototypes, and automatically generate embedded code.

Volkswagen generated AUTOSAR compliant software from Simulink models and integrated it into an existing ECU network for the first time.

Daimler designed, tested, and automatically generated production code for the Mercedes-Benz truck cruise control system in just 18 months.

Eaton Corporation developed an inexpensive, flexible controller for a medium-duty hybrid truck within stringent budgetary and time constraints.

Nissan designed an emission reduction system, certified by the California Air Resources Board for the Partial Zero Emission Vehicle standard, that lowered costs by reducing the number of sensors required on the vehicle.

Learn how these and other automotive companies are using MathWorks tools: www.mathworks.com/auto/userstories

“MATLAB®, Simulink®, and Stateflow®... have become the de facto standard at Toyota for simulation, data processing, and controls design. It would be impossible to list all of the applications for these tools at Toyota.”

— Akira Ohata, Toyota

“We worked closely with The MathWorks to integrate Model-Based Design, which accelerated the generation of code, eliminated many of the errors associated with hand-coding, and helped us contribute to developing open standards.”

– Bernd Kunkel, Volkswagen

MathWorks Products for Automotive

The MathWorks core products are MATLAB, a high-level programming language and technical computing environment, and Simulink, a block diagram environment for multidomain simulation and Model-Based Design. Add-on products for specialized applications include:

Control System Toolbox™

Design and analyze control systems

Data Acquisition Toolbox™

Acquire and send out data from plug-in data acquisition boards

Model-Based Calibration Toolbox™

Calibrate complex powertrain systems

PolySpace™ Code Verification Products

Detect run-time errors and prove code correctness before compile time

Real-Time Workshop®

Generate C code from Simulink models and MATLAB code

Real-Time Workshop® Embedded Coder™

Generate C and C++ code optimized for embedded systems

SimDriveline™

Model and simulate mechanical driveline systems

Simscape™

Model and simulate multidomain physical systems

Simulink® Design Verifier™

Generate tests and prove model properties using formal methods

Simulink® Verification and Validation™

Develop designs and test cases mapped to requirements and measure test coverage

Stateflow®

Design and simulate state machines and control logic

xPC Target™

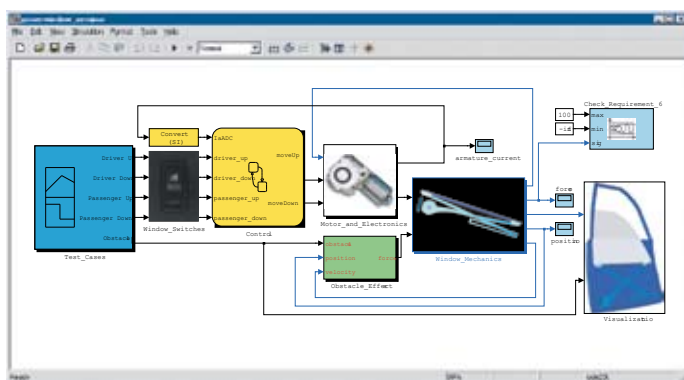
Perform real-time rapid prototyping and hardware-in-the-loop simulation using PC hardware

See a complete listing of MathWorks products for automotive:

www.mathworks.com/auto/products

The MathWorks Supports Industry Standards

- ASAM
- AUTOSAR
- IEC 61508
- MAAB
- MISRA



Model of a complete power window system, created using MathWorks tools for Model-Based Design. This design approach can easily be extended to other electromechanical or mechatronic systems in vehicles today.

Resources

VISIT

www.mathworks.com/auto

TECHNICAL SUPPORT

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ONLINE USER COMMUNITY

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www.mathworks.com/contact

E-MAIL

info@mathworks.com